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NOTE ON THE RENEWAL OF SCRAPED BARK SURFACES

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IN connection with the treatment of Brown Bast by the scraping method advised in Research Scheme Bulletin No. 48 it has been observed that bark surfaces so scraped renew at a much enhanced rate as compared with the renewal of bark surfaces after tapping. In fact, in a large number of cases where it has been found necessary to effect a scraping for Brown Bast over half the circumference of the tree, it has been observed that the thickness of the renewed bark after a period of one year from the time the surface was scraped has been greater than on the unscraped surface of the tree (tapped panel) after a period of three to four years. Again, it has been observed that the bark after such a scraping has a smoother surface and a softer consistency than the renewed bark after tapping. A sufficient number of observations have been made to satisfy the writer that the scraping method for Brown Bast could usefully be extended to bark surfaces which show extremely slow and irregular renewal. It was anticipated that the long periods of rest given to the trees during the restriction period would bring about a great improvement in the renewal of bark surfaces and in many cases this anticipation has been fulfilled. On the other hand, however, there has been a good deal of disappointment as the results even after prolonged rest have been unsatisfactory. Some reports have been received of better bark renewal having been secured from a course of manuring but other reports indicate that manurial applications have had no appreciable effect on bark renewal. It would appear, therefore, that manuring alone is not sufficient to stimulate the renewal of bark on trees which present a somewhat hide-bound condition and it is considered that in such cases the adoption of a scraping method similar to that for Brown Bast would prove beneficial.

The writer suggests that a thorough trial be given of the scraping method on trees which are known to renew their bark at a slower rate than the normal. The scraping should be carried out exactly as advised in Bulletin No. 48. The same care will be required to avoid wounding and the same precautions should be adopted throughout the treatment.

REPORT ON RUBBER FROM HIGH-YIELDING TREES AT HENERATGODA

AT the request of the Director of Agriculture in Ceylon six samples of rubber from individual trees at Heneratgoda gardens were forwarded for examination in order to judge the value of the trees as "mother" trees.

In forwarding the samples the Director stated that all six trees were amongst the highest yielders at Heneratgoda, two of them growing in plantation No. 1 and four in plantation No. 3. Plantation No. 1 dates from 1877 and was the first in Ceylon. Plantation No. 3 is believed to be composed of thinnings from plantation No. 1 or of cuttings left over in the original nurseries. All trees were tapped on alternate days on a single cut on one-third of the total circumference of the tree.

Each sample consisted of about eighty biscuits of unsmoked sheet varying in size, thickness and colour; some were mouldy. An appreciable amount of serum had exuded between some of the biscuits which were not quite dry. On the whole the amount of moisture in the rubber was less than 1 per cent.

It was stated that in the preparation of the samples the latex was collected at 11 a.m. each day and coagulated with acetic acid. After an interval of twenty hours the coagulum was submitted to "simple rolling to express the bulk of the water". Each biscuit was then soaked in 0·1 per cent. paranitrophenol solution for 30-60 minutes and placed on drying racks for a period of 4-6 weeks.

PLASTICITY TESTS.

The following are the results of plasticity tests on these samples:—

Sample no.	Plantation no.	Tree no	Length of cut.	Yield (April 1927-March 1928).	Number of grindings through laboratory rolls required to reduce rubber to a standard plasticity*.
			(ins.)	(lb.)	
(1)	(2)	(3)	(4)	(5)	(6)
1402	3	401	32	36·7	48
1403	1	2	46	50·6	57
1404	1	24†	26	49	35
1405	3	400	35½	45·1	46
1406	3	439	34	31·4	49
1407	3	445	39½	36·3	32

The figures in column 6 show that sample No. 1403 is the least and samples Nos. 1404 and 1407 the most plastic. The remaining samples do not differ greatly from each other in plasticity.

* The standard plasticity adopted is the rate of extrusion of 10 cc. per minute under load of 1,000 lb./sq. in. at 85°C.

† Suffering from *Ustulina* disease.

VULCANISATION AND MECHANICAL TESTS.

The following are the results of tests at the optimum tensile strength cure (Rubber-sulphur mixing 90:10) :—

Sample No.	Time of Vulcanisation at 148°C	Tensile Strength.	Elongation at load of 1·04 kgs./sq. mm.
	(mins.)	(lb./sq. in.)	(per cent.)
1402	90	2050	831
1403	120	2000	795
1404	90	2230	749
1405	90	2300	795
1406	110	2480	729
1407	100	2440	720

All the samples have satisfactory tensile strengths except 1402 and 1403 which are definitely weaker than most samples of unsmoked sheet. Some of the samples are exceptional in that their maximum tensile strength is developed at a low elongation under a load of 1.04 kgs/sq. mm.

VULCANISATION AND AGEING TESTS.

The following are the results of vulcanising and artificial ageing tests.

Sample no.	Time of vulcanisation at 148°C.	Period of ageing at 70°C.	Tensile strength.	Elongation at load of 1·04 kgs./sq. mm.
	(mins.)	(hrs.)	(lbs/sq. in.)	(per cent.)
1402	80	nil	1580	852
		48	2310	777
		96	1820	733
		144	1380	700
1403	93	nil	1820	844
		48	2150	740
		96	1490	711
		144	220	—
1404	62	nil	1800	875
		48	2190	745
		96	1470	721
		144	370	—
1405	75	nil	1800	840
		48	2260	745
		96	1820	713
		144	270	—
1406	75	nil	1650	857
		48	2310	770
		96	1310	690
		144	280	—
1407	73	nil	1780	842
		48	2030	741
		96	1600	725
		144	270	—

Sample 1403, which is a hard rubber, vulcanised slowly, and sample 1404, which is a soft rubber, vulcanised quickly. The rate of vulcanisation of the remaining samples was similar to that of samples of unsmoked sheet previously examined.

All the samples gave satisfactory results in the artificial ageing tests. The maximum tensile strengths, however, are not quite so good as those usually obtained with sheet rubber.

CONCLUSIONS.

The following conclusions are drawn from these tests:—

1. The rubber from trees Nos. 400, 401, 439 and 445 is of satisfactory quality as regards plasticity, rate of vulcanisation and ageing.

2. The rubber from tree No. 24, which is suffering from *Ustulina* disease, is quick curing, judged by the usual standards. In other respects the rubber is normal.

3. The rubber from tree No. 2, from which a considerable amount of budwood is being obtained, is abnormal in several respects. The sample examined was somewhat harder than the others, had a long period of vulcanisation, and was rather weak.

No conclusions can be drawn from the experiments as to the suitability of the trees as "mother" trees. More information is needed concerning the relation between the quality of rubber yielded by "mother" trees and by established clones derived from them before arriving at a decision on this point. The limited work that has been done comparing the properties of rubber from "mother" trees and buds favours the view that the same abnormalities occur in both cases, but the investigations are not sufficiently extensive for definite conclusions (de Vries, *Archief. v. de Rubbercultuur* March 1924 p.127, de Vries, and Spoon, id., April 1927. p. 146).

Other difficulties arise in considering the bearing of the results of this investigation on the suitability of the trees as "mother" trees. For example, tree No. 24, which yielded the quickly vulcanising rubber, is suffering from *Ustulina* disease. This condition is abnormal and may be responsible for the quick rate of vulcanisation of the rubber. Tree No. 2, which yielded the hard, slowly vulcanising, weak rubber, has had half its branches pollarded for budwood. According to de Vries (Estate Rubber, p.467), this treatment would tend to produce weakness in the rubber.

Moreover, the variation in the appearance of the biscuits in each sample suggests that the method of preparation cannot be maintained uniform throughout the experiment. For example, some of the biscuits are very thin and some comparatively thick, and it is therefore possible that the amount of serum retained is irregular. Variations in the rate of drying had also occurred as some of the biscuits were distinctly wet on arrival in London.

Each of these factors has a considerable effect on vulcanising properties. A portion of each biscuit was included in the sample drawn for examination with a view to obtaining an average result, but the comparison of the samples would have been more satisfactory if the appearance and form of the individual biscuits had been less varied.

Imperial Institute,
London,
November, 1928.

BUDGRAFTING OF RUBBER

C. E. A. DIAS

[The following article was published by Mr. C. E. A. Dias in the local press. It is reproduced here at Mr. Dias' request and is followed by a reply to Mr. Dias' statements. *Ed. T. A.*]

IT is a great pity that budgrafting of rubber as a means of obtaining increased yields of rubber from the same area is not taken up as largely as it ought to be. This may be partly due to certain theories which have been put forward by our technical officers. At one time it was said that the age of the budwood and stock should be the same, or, in other words, the mother tree should be pollarded at the time the seed is planted for stock. I have completely proved the fallacy of this statement by getting budwood of ages from three months to couple of years old to take on to stock varying from nine months to eighteen years old.

After this, it was put forward that one must prove the stock before budgrafting is undertaken on a commercial scale. I cannot understand this at all. Our Department of Agriculture and the Rubber Research Scheme are unnecessarily delaying the work of pushing on with budgrafting to prove the mother trees until they are able to secure sufficient seed from stock of known trees, as they have a belief that the bud grafted on is influenced by the stock. In Ceylon, we have no pure line seed for stock in any case. The only seed we have in Ceylon is illegitimate seed as only the parentage of one side is known, and granted that the stock can influence the scion, with illegitimate seed one cannot expect the same influence.

I am now able to prove to a certain extent that the growth of the scion is not at all influenced by the stock, and the theory put forward by the Ceylon technical officers may not be correct. For the present, I am confining my attention only to the growth of the scion and not to the yield.

After the bud has taken on to the stock and starts growing, and from the time the stock is cut off at the union of the stock and scion, the stock begins to cease functioning, and very soon gets into a dormant state. As the bud or scion grows, it develops all round enveloping the stock, the tap root and laterals completely, and grows on its own, not only developing wood and bark over the union, but also enveloping the tap root and laterals. This new discovery was made by me a few days ago. I examined several sections of different ages. In every case it can be

The photograph mentioned in Mr. Dias' paper.

clearly seen that the stock attains a dormant state and is enveloped by the scion it has taken on. If this ocular demonstration is correct, and if the stock increases neither in girth, breadth, length, nor in any other manner, what influence can such a stock bear on its guest who has got hold of his little cottage and built a mansion all round it? It is not a case of the scion living on the stock and its root system. The idea that there is one plant above the union and another below it will have to be dispelled.

Have any of our technical officers ever examined a rubber union of stock and scion with a view to finding out what is taking place inside?

A longitudinal section of a budded rubber tree will prove all I say above.

I have not seen a section of this sort or a photograph of such a section anywhere before this, not even in the Netherland Indies where they have samples and photographs of everything imaginable with regard to rubber. I have photographed a longitudinal section of a budded rubber tree and hope to send you a copy in a few days for publication, as this would be the first photograph of this nature. If anyone interested cares to see these sections, they are at liberty to see and examine them either in my office in Colombo or at my laboratory on my Wawulugala Estate, Horana.

THE RELATIONSHIP BETWEEN STOCK AND SCION IN BUDDED PLANTS.

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THERE has recently appeared in the local press a communication from Mr. C. E. A. Dias suggesting that the relationship believed to exist between stock and scion in budded rubber plants and their relative importance in the production of the final composite plant is not in accordance with the views previously held by botanists. In this communication it is stated that the scion is the only important member of the budded plant after union has been established and that the stock ceases to function after the bud has commenced its growth. It is further stated that the tissue produced by the growing scion envelops the stock in such a way as to completely enclose it and that afterwards the roots, stem and branches consist entirely of tissue derived from the scion. As these statements are open to doubt, it is considered necessary to give an explanation of what takes place after budding has been successfully carried out and the shoot has commenced its growth.

Development of budshoots.—In the early stages of its existence a bud is completely embedded in the cortex, has no connection with the wood of the stem, and can be seen as a small pimple when a bud patch is removed. When growth of the bud begins, tissue is produced both inwardly and outwardly. The budshoot gradually becomes attached by woody tissue to the wood of the stem and at the same time grows outwards to form a branch. The same process takes place no matter whether the bud develops on the stem on which it was originally produced or whether it has been transplanted to another plant, as in budding. When the top of a plant is cut off, one of the dormant buds beneath the cut develops and the shoot produced takes the place of the original stem. In the case of a budded plant care is taken that the transplanted bud only is allowed to shoot. The portion of the old stem remaining above the developing shoot then dies off. The tissue formed subsequently does not envelop any of the portion below the point of origin or attachment.

Proof of this can be obtained by sectioning in a longitudinal direction a sample of bark taken across the union of stock and scion in a budded plant. Such a section will show that in the symbiotic union produced in budded plants each of the symbionts retains its own characteristics. This is illustrated in fig. 1 which

is a semi-diagrammatic drawing of a longitudinal section of bark cut through the point of union. It will be seen that there are fewer stone cells in the stock portion than in the scion portion and that the other characters of the two cortices are quite different, each having retained its own special features. Fig. 2 shows photographs of longitudinal median sections through the top of a normal stump and it will be noted that they present exactly the same appearance as longitudinal sections through a stump which has been budded. The sections of fig. 2 should be compared with Mr. Dias' photograph of his sections.

The sharp line between the old and the new tissue of the stock is merely the result of the check to the growth of the stock when it was cut off (stumped). It is this sharp line that has given the impression that the tissue of the scion is enveloping the old stock. Actually the old and the new tissues of the stock are continuous; they are merely marked off from each other by the zone of smaller-celled tissue formed during the period between the removal of the stem of the stock and the development of the bud shoot. The same sharp line occurs in all rubber plants which have been cut off whether budding has taken place or not.

A similar phenomenon is that of the annual rings shown by deciduous trees in temperate climates. These are merely zones of small-celled tissue formed during the wintering periods and the enclosure of the old tissue by new tissue formed in the following season is exactly the same as the enclosure of the old tissue of the stock by the new tissue of the stock after it has been stumped. There is no question of the envelopment of the stock by the scion.

Importance of stocks.—In the present state of our knowledge of rubber it is not possible to make any reliable statements as to the influence of stock over scion but in view of the work which has been done on other plants it would be a mistake to neglect the possibility of such influence. In fruit crops where knowledge of budding or grafting has reached a much more advanced stage than in rubber it has been found that the nature of the stock has a very important influence on the resultant plant.

An abstract from a paper by R. G. Hatton entitled "The influence of different root stocks upon the vigour and productivity of the variety budded or grafted thereon" (Journal of Pom. and Hort. Sci., Vol. VI., No. 1, Feb. 1927), states: "These figures (given in the article) show that a single variety of apple budded upon four distinct varieties of root stock behaves very differently upon each, both in the amount of wood growth it makes and the fruit it produces. On one root stock it may make five times the wood growth that it does upon another; or again it may fruit ten times as heavily"....."It is claimed that a much greater control has been established over the tree than heretofore, as a result of a more precise knowledge of the influence of root stocks." Again,

other experiments have shown than where "double working" has been employed the variety used as an intermediate stock has had a distinct influence on the vigour of the second scion. In vine cultivation in France the stock is varied according to the nature of the soil, and in citrus culture the stock has been shown to have an important influence on growth and fruiting.

There is, in fact, a considerable amount of information available on the subject of the influence of stock on scion which goes to show that while each retains its general characteristics there is a decided inter-effect between the two. Consequently no research work on budgrafting in rubber should be carried out without keeping in mind the possibility of such influence, and the statement that the Rubber Research Scheme may be wasting valuable time in an endeavour to study this problem is not justified.

The following extract from the progress report of the Experiment Station, Peradeniya, for September, October, 1928 is of interest in this respect and should be carefully noted. "In plot 174, planted with budded rubber in November 1927, it was noticed that some plants had made greatly superior growth to the majority. It was found that 30% of the better grown plants were growing on their own stocks, whereas only 17% of the total number of trees are growing on their own stocks. It was also noted that 43% of the well-grown trees growing on their own stocks were Heneratgoda No. 2 budded on Heneratgoda No. 2 stocks."

The statement that delays have taken place owing to a desire to select good stocks as well as good scions is erroneous, for stocks of known parentage on one side have always been available. It has not been necessary to use stocks of entirely unknown parentage in the work being done by the Research Scheme.

Finally, the statement that no scientist in the research stations of the East has ever sectioned a budded plant is inaccurate, for in the *Archief voor de Rubbercultuur* for 1922 there is an article on the subject by Dr. Visher containing complete diagrams. In 1922 and 1923 respectively two officers of the Rubber Research Scheme had, while in Java, the privilege of examining the original sections used in the writing of that article.

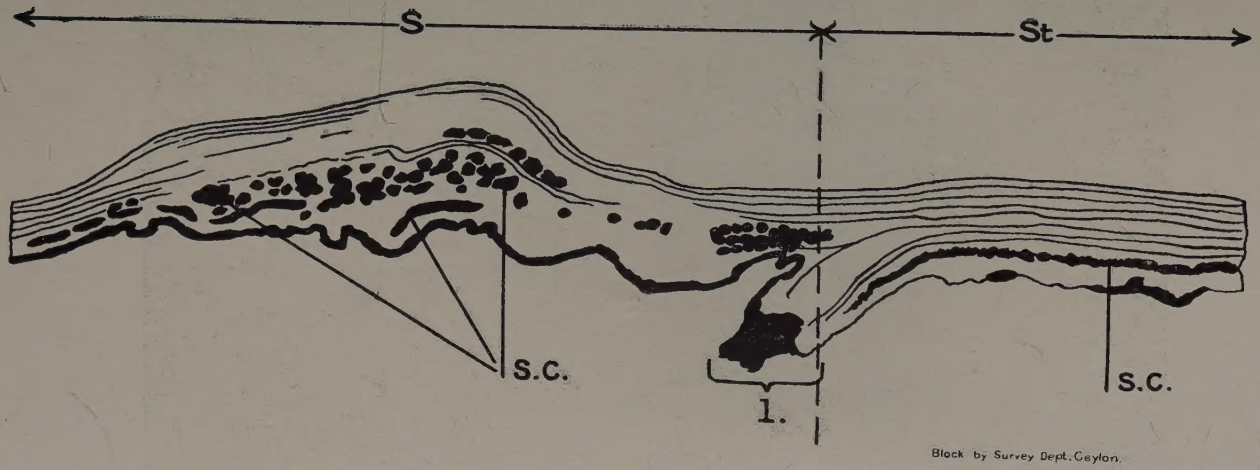

Fig. 1. Longitudinal tangential section of cortex taken across the union of stock and scion. S, scion; St. stock; s.c., stone cells; l, the lip left after the breaking off of the flap of bark which is folded over the attached bud for the first week or two after budding.

Fig. 2. Longitudinal sections through unbudded plants which have been stumped, showing the original stem and also the portion produced by the developing bud. Compare with similar section of budded plant.

NOTICES.

SUBSCRIPTIONS.

Arrangements have now been made for Bulletins of the Ceylon Rubber Research Scheme to be made available to non-contributors to the Scheme at the rate of Rs. 15-00 per annum, post free.

OFF-COLOURED CREPE.

The Chemist to the Rubber Research Scheme would be glad to get into touch with the Superintendent of any estate who is troubled with off-colour crepe, and who thinks that this may be due to impurities in the water used for manufacture.

GLASS METROLOCS.

Glass Hydrometers for testing latex as specified and as recommended by the Rubber Research Scheme (Ceylon) may be obtained at a cost of Rs. 12-50 each from :—

Messrs. WALKER, SONS & Co., Ltd.,
Engineering & Estate Supplies Department,
Colombo.